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Evaluation of Different Insecticide Formulations Against *Lipaphis erysimi* (Hemiptera: Aphididae), a Pest on Oil Seed Crop, *Camelina sativa* in Pakistan

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ABSTRACT

False flax, German sesame and Siberian oilseed are the names used for oil seed crop, *Camelina sativa* L. Crantz of the family Brassicaceae. *Camelina sativa* is a flexible, summer annual oilseed crop that can be raised in different climatic and soil conditions. The objectives of this study were to test the efficacy of different insecticides against aphid, *Lipaphis erysimi* on Canadian and Australian *Camelina sativa* varieties. Insecticides were tested at their field recommended doses using knapsack sprayer. The data on adult mortality of *Lipaphis erysimi* were recorded after 24, 48, 72, 96 and 120 h. Acetamiprid and mospilon were found more effective in controlling aphid. For Canadian variety, after 5 days of application, maximum mortality was recorded for acetamiprid (98.70%) while least was observed for diafenthiuron (53.52%). In case of Australian camelina, maximum mortality (98.26%) of aphid were found using acetamiprid. Acetamiprid was the most effective insecticide to control aphid in both varieties of *Camelina sativa*.

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MA and RRK designed the project and wrote the article. MA performed the experimental work. MIU collected and analyzed the data. M. Afzal, BT helped in data analysis. IM performed statistical analysis. RRK supervised the research work. JEF helped in preparation of manuscript and interpretation of data.

Key words
Aphid, *Camelina sativa*, insecticides, efficacy, oil seed crop, canola.

INTRODUCTION

Canola is attaining the prominent position as an important source of plant protein and oilseed crop in Pakistan. It does not only serve as an important nutritive element for the people, but also used in the food industry (Mahmood *et al*., 2012). A large number of oil seed crops are grown in various areas of Pakistan, yet the amount of oil is not sufficient to meet our needs (Razaq *et al*., 2014). Accordingly, we have to import a large amount of edible oil 143.5 (000 tones) from other countries. So, a huge amount of foreign exchange amounting to 19044.8 million rupees is used to import the edible oil (Sarwar *et al*., 2003). During the years 2009-10, edible oil production was approximately 1.749 million tons in Pakistan. Increasing demand of edible oil, fluctuations in domestic production and continuous increase in the imports are the central features of today's edible oil situation in the Pakistan (GOP, 2010).

Seeds of camelina contain 28–40 wt% of vegetable oil, which is extremely greater to that typically found in soybean (18–22 wt%) (Moser and Vaughn, 2010). Two species are commonly used for the production of edible oil: spring camelina (*Camelina sativa* L. Crantz) and fall camelina (*Camelina silvestris* Wallr) while spring camelina is considered best for biofuels. The length of seed and fruits of *C. sativa* is larger than *C. silvestris* (Mirekz, 1980). Cultivation of camelina crop is increased due to its potential for biofuel production and low agronomic inputs required for cultivation (Dober and Jurcone, 2011).

C. sativa is a broad leaf, spring annual oilseed crop that may be cultivated well in temperate climates. Unlike other commonly grown oilseed crops like canola, rapeseed, soybean and sunflower, *C. sativa* does not require much water, pesticide and fertilizer. The average yield of camelina crop is 420–640 L/ha while protein and fiber contents in camelina is comparable to that of soybean meal (Moser and Vaughn, 2010). Because camelina is relatively a new crop, susceptibility to insect and disease pest is not well understood. Insect pests such as flea beetle, aphid and cabbage seed pod weevil that commonly affect canola have not been observed in camelina crop (Mcvay and Lamb, 2008). High resistance to flea beetle feeding has been reported for *C. sativa* (Dosdall and Stevenson, 2005; Pachagounder *et al*., 1998; Soroka *et al*., 2003).

Unfortunately, this crop is under threat of severe attack of aphid in Pakistan. In Pakistan, camelina crop is newly introduced and few insect pests have been found that cause serious damage to canola crop in Pakistan (Ali

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and Munir, 1984). Among these insect pests, aphid, *Lipaphis erysimi* (Kalt.), is considered to be the most important insect pest, which is responsible for a yield loss ranging from 35.4 to 96 percent depending upon seasons. Nymphs and adults of aphid contribute significantly to plant damage by feeding on the plant and often covering the entire surface of flower buds, shoots and pods (Bakhetia, 1986). For controlling *L. erysimi*, successful insecticides should be applied at appropriate doses. Several researchers have investigated efficacy of various insecticides like acetamiprid, diafenthiuron, and thiamethoxam against mustard aphid, *L. erysimi* in mustard crop (Chalam *et al.*, 2003; Dhaka *et al.*, 2009). This crop can play an important role in achieving the demand of edible oil if it is grown in large areas and appropriate management strategies are used for the control of aphid insect pest. Thus the current research is focused to evaluate the efficacy of various insecticides (acetamiprid, mospilon, diafenthiuron and profenofos) against *L. erysimi* in two different varieties of camelina crop in Pakistan.

MATERIALS AND METHODS

The experimental trial was conducted on two camelina varieties (Canadian and Australian) planted in November 2012 by hand drill method at a seed rate of 5 kg/ha. Standard cultural practices were followed. The experiment was laid out in a Randomized Complete Block Design having three replications. Camelina crop was monitored from germination to maturity for recording insect pests. Populations of insect pests were recorded on weekly basis. Aphid, *L. erysimi* were observed as the major insect pest. Aphid population was recorded from randomly selected five plants of each treatment. The method of sampling *L. erysimi* was similar to that of adopted by Singh *et al.* (1987) and Chattopadhyay *et al.* (2005). The insecticides, their recommended doses used are shown in Table I. Water was used as control.

Table I.- List of insecticides (brand and common names) and their recommended doses.

Treatment	Brand Names	Common Names	Dose/acre
T1	Moziban	Acetamiprid	125ml
T2	Curacron	Profenofos	1000ml
T3	Mospilon	Acetamiprid	50 g
T4	Polo	Diafenthiuron	200 ml
T5	Control	Water	

Spray applications of the insecticides were carried out with a hand operated knapsack sprayer using a hollow cone nozzle (KB-5C, Kobold, China). The sprayer tank volume was 5L with work pressure of 1-3 bar. The data were recorded after 24, 48, 72, 96 and 120 h of application. The data of mean aphid mortality were subjected to analysis of variance (ANOVA) by using MSTATC, computer software (MSU 1982). Means were compared using least significant difference (LSD) Test at probability (p=0.05).

RESULTS

The results on the reduction percentages in the population of *L. erysimi* after different time interval of application are presented in Table II. All the insecticides reduced the aphid population compared to that in control plots but acetamiprid consistently proved better than other treatments up to 5 days after applications. The results supported previous findings (Ali and Munir, 1984; Chalam *et al.*, 2003) which reported that acetamiprid was effective for control of aphid.

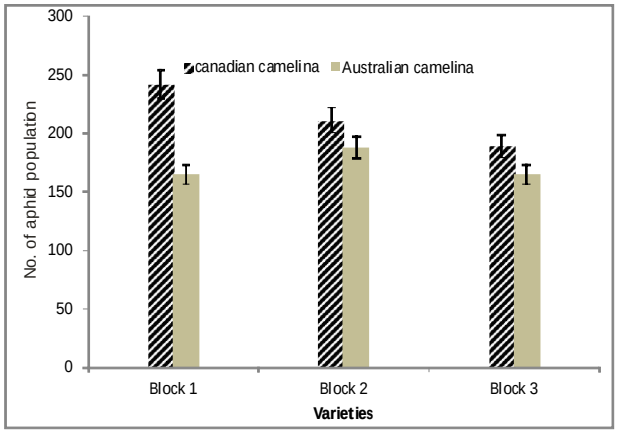

Fig.1. Mean numbers of *L. erysimi* on Canadian and Australian camelina.

Higher population of *L. erysimi* before application was observed in Canadian camelina as compared to Australian camelina in all three blocks.

The data of mortality of *L. erysimi* were taken after 24, 48, 72, 96 and 120 h. Application of acetamiprid and mospilon resulted in higher mortality of the insects as compared to profenofos and diafenthiuron. Maximum mortality of the insects in Canadian camelina after 120 h was 98.70%, 90.78%, 63.18% and 53.52% of acetamiprid, mospilon, profenofos and diafenthiuron, respectively (Table II). In case of Australian camelina, maximum mortality after 120 h was 98.26%, 93.58%, 81.22% and 67.30% of acetamiprid, mospilon, profenofos and diafenthiuron respectively. Acetamiprid was most

Table II.- Percentage mortality (± SE) of *Lipaphis erysimi,* treatment of various insecticides in Canadian and Australian camelina.

Insecticides	After 24 h	After 48 h	After 72 h	After 96 h	After 120 h
Canadian camelina					
Acetamiprid	29.35±3.1	45.03±1.8	60.00±1.2	94.55±1.7	98.70±0.5
Mospilon	18.21±1	27.68±1.9	51.88±1	72.61±0.8	90.78±3.5
Profenofos	15.67±1.2	22.22±1.4	38.18±1.4	53.79±2.3	63.18±2.1
Diafenthiuron	5.73±0.8	17.08±1.2	31.62±1.4	48.78±1.6	53.52±3.6
Control	0.0000	0.0000	0.000±0.5	0.0000±0.5	0.0000±1.5
Australian camelina					
Acetamiprid	20.49±1.21	42.63±1.7	62.13±2	87.13±2.3	98.26±0.4
Mospilon	17.93±1	29.70±2.2	46.11±4.7	76.23±3.5	93.58±1
Profenofos	12.30±0.46	21.78±2.6	34.45±3.6	57.91±4.2	81.22±0.9
Diafenthiuron	6.50±0.73	11.91±0.9	28.08±2.2	47.58±1.9	67.30±2.5
Control	0.0000	0.0000	0.0000	0.0000±1.1	0.0000±0.7

effective in both varieties of *C. sativa* (Table II). The reduction percentage was significantly higher from treatment sprayed with acetamiprid and its difference with other treatments is statistically significant.

DISCUSSION

C. sativa is an oil seed crop that belongs to family Brassicaceae which includes many species. *L. erysimi* is a serious pest among economic insect pest species that attack the Brassica crops. The insect causes economic losses and is responsible for a yield loss ranging from 35.4 to 96 percent depending upon seasons (Bakhetia 1986). The results of the present study indicated that the aphid is one of the serious pests of camelina crop in Pakistan. Its damage is more severe at flowering and fruit formation stages.

The difference between populations of *L. erysimi* on both varieties might be due to morphological characteristics of plant. There is very limited literature found on Australian camelina, however there is a probability that non-preference of *L. erysimi* to this crop may involve some host plant resistance mechanisms. The Canadian camelina leaves are only shallowly toothed but Australian camelina leaves are deeply toothed or lobed and leaf area index is higher than Canadian camelina. Australian camelina leaves are hairier than those of Canadian camelina (Al-Shehbaz and Beilstein, 2010; Francis and Warwick, 2009). Chemical control still remains an important tool of pest control and is also essential in the concept of Integrated Pest Management. For the efficacy, acetamiprid and mospilon were more effective insecticides as compared to profenofos and diafenthiuron. Average mortality after 120 h was 98.70%, 90.78%, 63.18% and 53.52% of acetamiprid, mospilon, profenofos and diafenthiuron respectively in Canadian camelina (Table II). In case of Australian camelina average mortality after 120 h was 98.26%, 93.58%, 81.22% and 67.30% of acetamiprid, mospilon, profenofos and diafenthiuron respectively. Acetamiprid was most effective insecticide in both varieties of *C. sativa* (Table II).

The present result showed that acetamiprid performed well in reducing population of *L. erysimi* on camelina crop followed by mospilon, profenofos and diafenthiuron, but their effectiveness almost non-significant with each other. However, acetamiprid performed well in reducing the population of aphid on both varieties of camelina crop.

The results of present study strongly agree with (Chalam *et al.*, 2003) in which they used acetamiprid, diafenthiuron, and thiamethoxam against aphid. The result of their study showed that acetmaprid was more effective than diafenthiuron and thiamethoxam against aphid populations. Our results are also in consistence with the findings of Dhaka *et al.* (2009) who studied the efficacy of newer insecticides against mustard aphid, *L. erysimi* on Indian mustard. Acetamiprid 20 SP (125 g/ha) proved as the best insecticide followed by acephate, thiamethoxam, imidacloprid, profenofos, dimethoate and oxydemeton methyl for the management of aphids. Farooq and Tasawar (2009) studied the efficacy of five insecticides *viz.*, Confidor 200 SL (imidacloprid), Mospilan 20SP (acetamiprid), Advantage 20 EC (carbosulfan), Actara 25 WP (thiomethoxan) and Lannate 40SP (methomyl) against aphid. The results showed that acetamiprid and imidacloprid gave best result against aphid. Our findings also support the results from many

researchers that acetamiprid was very effective against various pests.

The reports concerning about expansion of insecticide resistance against conventional insecticides have elevated serious concerns about their efficacy in the field. But the neonicotinoids like imidacloprid and acetamiprid proved highly effective for farmers because of different mode of action as compared to the previous insecticides. Acetamiprid be in the right place to second generation of the nicotinoids. It is systemic insecticide having translaminar activity and both contact and stomach mode of actions. Its foliar spray is very effective against aphid compared to other insecticides. Due to their mode of action, there is little or no cross-resistance to older insecticides such as pyrethroids, organophosphates, chlorinated hydrocarbons, and carbamates. Neonicotinoids are now replacing previous insecticides for insect control on many major crops (Denholm *et al.*, 2002).

CONCLUSIONS

Findings of the study clearly indicated that acetamiprid was the most effective insecticide against *L. erysimi* followed by mospilon compared to diafenthiuron and profenofos in respect of aphid populations. The use of acetamiprid and mospilon were found to be more toxic insecticides to *L. erysimi.* Therefore, application of acetamiprid is recommended on camelina crop for the control of *L. erysimi.*

Statement of conflict of interest

Authors have declared no conflict of interest.

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